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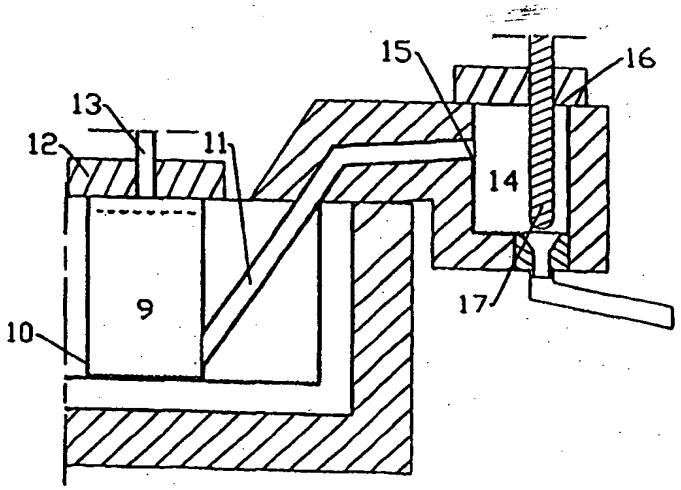
(54) Title: METHOD AND APPARATUS FOR MELTING NON–FERROUS METALS, ESPECIALLY MAGNESIUM



(57) Abstract

The invention relates to a method and apparatus for melting of non–ferrous metals, especially magnesium. The metal material is charged into a furnace chamber (1) and flows through openings (6; 7) in the intermediate furnace chamber walls (4; 5) via a main melting chamber (2) to an outlet chamber (3), from where it is pumped using a pneumatic pump chamber (9) through its upwards slanting pipe (11) to a separate dosing chamber or dosing furnace (14) and further through a bottom valve (17) to the casting device. The invention aims at improving the dosing accuracy in an economical way. This has been accomplished by pumping the melt through said outlet pipe (11) to said dosing chamber or dosing furnace (14) in such a way that excessive metal flows back to said pump chamber (11) through the same pipe while the correct amount of metal, using a clock–controlled valve (17), flows to the casting device.

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Method and apparatus for melting non-ferrous metals, especially magnesium

When melting non-ferrous metals, especially magnesium, a precise dosing of the molten metal is required. Pumping of the melt from the melting furnace to the casting device is already known, for example utilizing complicated pressure and vacuum systems. Another known method is to pump the melt via a pipe to a separate dosing tank, where the melt level is kept constant in such a way that excessive molten metal flows back to the melting furnace via another return pipe. Since the distance between melting furnace and dosing tank may be considerable, i.e. several meters, this also constitutes an expensive solution.

Our invention, which will be described below, results - contrary to the prior art - in a safe and economical solution to the problem. The main characteristics of our invention are defined in claims 1-3.

The furnace according to our invention, Fig.1, comprises an inlet chamber 1, a main melting chamber 2 and an outlet chamber 3. In the intermediate walls 4 and 5 between the chambers there are openings 6 and 7 close to the bottom, through which openings the fully or partly molten metal may flow. When the melt flows from chamber to chamber a successive cleaning of the metal takes place, especially in case a filter 8 is placed in the wall opening or openings. The impurities are taken away as need arises. The heating of the furnace is not shown.

Molten metal may be fed to the casting device manually or using an automatic ladle.

A preferred method is however to feed the melt utilizing a pneumatic pumping system as shown schematically in Fig.2. In the outlet chamber there is located in this case a pump chamber 9, which has a small inlet opening 10 and a larger outlet pipe 11. The pump chamber is hermetically closed by the lid 12.

When over-pressure via a pipe 13 in the pump chamber lid, in accordance with a method earlier patented by us, is applied on the metal surface in the pump chamber using a suitable gas, e.g. nitrogen, molten metal will be forced out through the outlet pipe.

The outlet pipe 11 is connected to the upper part of a tank being a separate chamber in the melting furnace or a small and completely separate dosing furnace 14. The lower inner surface 15 of this outlet pipe shall at its outlet end be at a level slightly higher than the maximum metal level in the melting furnace, but so much lower than the upper edge 16 of the dosing furnace or chamber that the amount of melt, that one pump stroke pumps out, may be contained in the dosing furnace or chamber with no over-filling. This amount of melt pumped out by one pump stroke may be calculated approximately and measured experimentally.

When the over-pressure after the end of each pump stroke ends, the excessive molten metal flows back to the pump chamber through the same pipe 11, meaning that the level control is automatic although the pump is working continiously, except for the short, adjustable intervals between each pump stroke.

In the bottom of the dosing furnace or chamber 14 there is a valve 17, which will open on a signal from the casting device. A clock controls the time this valve stays open. Since the level in the dosing furnce or chamber will be nearly constant, the result will be a precise dosing. In case the valve is computer controlled the dosing rate may also be changed in a controlled manner.

Claims

1. A method for melting non-ferrous metals, especially magnesium, comprising a melting furnace having two or more chambers with lids, where the molten metal and the charged material flows from the inlet chamber (1) via the main melting chamber (2) to the outlet chamber (3) through openings (6;7) in the intermediate walls (4;5), from where the melt, using a pneumatic pump chamber (9) located in said outlet chamber, is pumped via an upwards slanting outlet pipe (11) to a separate dosing chamber or dosing furnace (14) and further via a bottom valve (17) to the casting device, **characterized** in that metal flow from the melting furnace to said dosing chamber or dosing furnace caused by an intermittent over-pressure in said pump chamber does not result in over-filling of said dosing chamber or dosing furnace and in that an excessive amount of metal flows back to said pump chamber in the melting furnace through the same pipe, as soon as the over-pressure after each pump stroke ends, wherefor the metal level in said dosing chamber or dosing furnace remains constant.

2. An apparatus for implementing claim 1, comprising a melting furnace having two or more chambers with lids, where the molten metal and the charged material flow from the inlet chamber (1) via the main melting chamber (2) to the outlet chamber (3) through openings (6;7) in the intermediate walls (4;5), from where the melt using a pneumatic pump chamber (9) located in said outlet chamber, is pumped via an uppwards slanting outlet pipe (11) to a separate dosing chamber or dosing furnace (14) and further via a bottom valve (17) to the casting device, **characterized** in that said upwards slanting outlet pipe (11) also functions as a return channel for excessive metal flowing back to the said pump chamber as soon as the over-pressure after each pump stroke ends, resulting in no over-filling of said dosing chamber or dosing furnace and keeping its metal level constant.

3. An apparatus for implementing claim 2, **characterized** in that the lower inner surface (15) of the upwards slanting outlet pipe (11) at its upper outlet end is at a level slightly higher than the maximum metal level in the outlet chamber (3), but so much lower than the upper edge (16) of the dosing chamber or dosing furnace, that the amount of metal one pump stroke delivers, does not result in over-filling of the dosing chamber or dosing furnace (14).

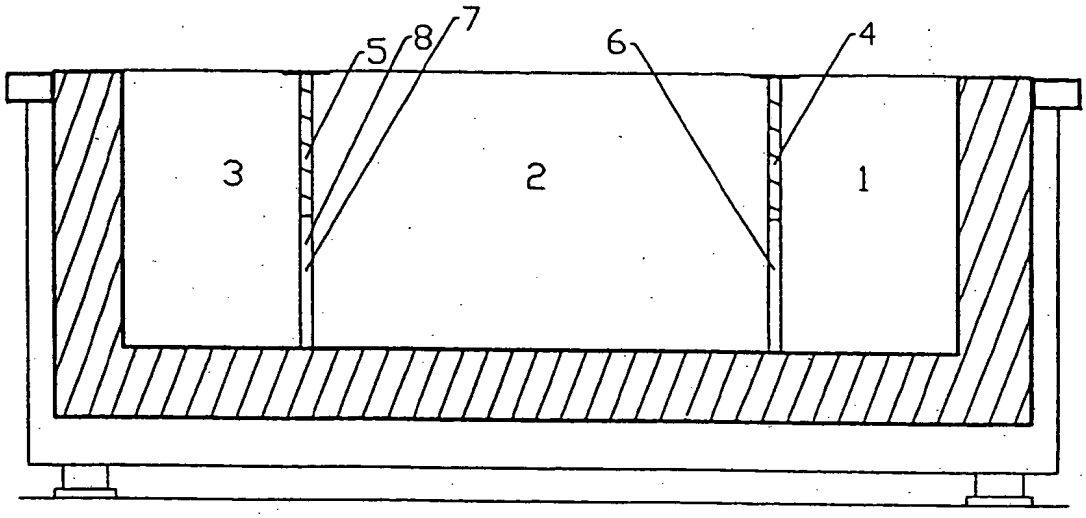

Fig. 1

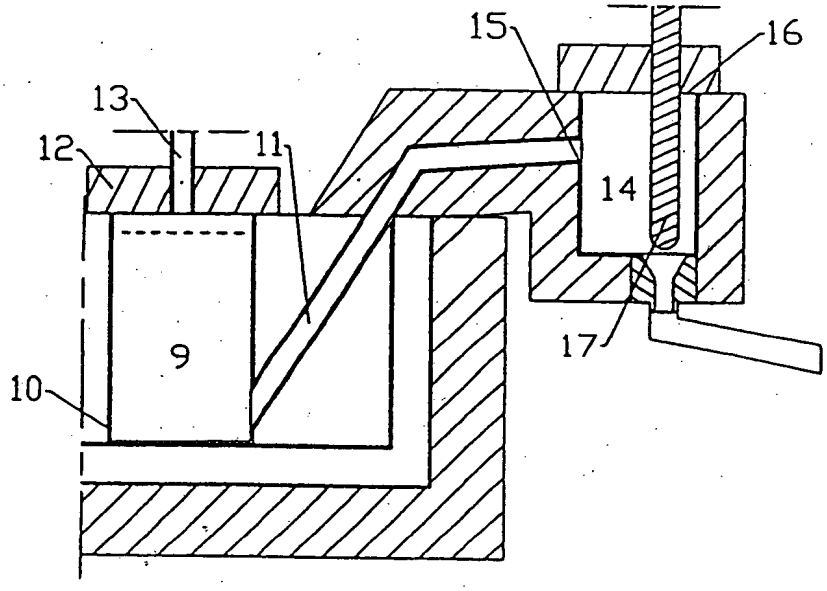

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00676

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B22D 39/06, C22B 26/22
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: C22B, B22D, G01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DE 4439214 A1 (SCHMITZ + APELT LOI INDUSTRIEOFENANLAGEN GMBH), 9 May 1996 (09.05.96), figure 1 --	1-3
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A	Patent Abstracts of Japan, Vol 95,No 831 abstract of JP 70-88630 A (HIROSHIMA ALUM KOGYO KK), 4 April 1995 (04.04.95) --	1-3

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
22 June 1998	25-06-1998
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

09/06/98

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PCT/FI 97/00676

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